Policy, Research, and External Affairs

WORKING PAPERS

International Economic Analysis
and Prospects

International Economics Department
The World Bank

April 1991
WPS 641

Intertemporal Substitution in Consumption

Evidence for Some High- and Middle-Income Countries

Karsten N. Pedersen

When credit constraints are taken into account, support is found for an optimizing life-cycle model of consumption for a group of high- and middle-income countries. These results suggest that consumption by individuals is best described when it is assumed that one part of individuals plans consumption in a classical optimizing fashion, and another part follows a more Keynesian plan, where consumer expenditures are related to current income.

Policy, Research, and External Affairs

WORKING PAPERS

International Economic Analysis
and Prospects

WPS 641

This paper is a product of the global modelling project in the International Economic Analysis and Prospects Division, International Economics Department. The analysis here contributes to the specification of a North/South model with consistent intertemporal linkages that will serve the division's long-term forecasting and scenario analysis for outlook papers. Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Milena Hileman, room S8-214, extension 31284 (16 pages).

Pedersen tries to find support for the life-cycle model of consumption in a sample of middle- and high-income countries. He puts forward an intertemporal model of consumption that allows credit rationing for a fraction of consumers (with credit rationing defined as constraints on consumption for lack of access to credit markets).

If consumers cannot borrow against human wealth and have no financial wealth, their consumption is limited to current income. But the fraction of consumers for whom credit is rationed changes over time, as monetary authorities apply different quantitative instruments and as financial markets evolve.

Assuming rational expectations throughout, Pedersen concludes that:

• Overall, the results support the life-cycle model of consumption. Not all intertemporal elasticities of substitution are estimated at significant levels. But first order conditions of the life-cycle model, often referred to as Euler equations, are estimated in well-behaved domains for all countries when terms of credit rationing are included. Thus, one part of consumers seems to plan spending according to expectations of future real interest rates and future income expectations, while another part is tied to the current level of income because of lack of credit opportunities. Also, tests seem to approve the assumed expectation formation. The axiom of the efficient market hypothesis is accepted at 5 percent for all countries but one, and the information set's orthogonality to consumption innovations is not violated for any country.

• There is more credit rationing in middle-income than in higher-income countries. And models for middle-income countries are estimated with more uncertainty (higher standard errors of regression), which may indicate that the assumption of a representative consumer is particularly vulnerable in the middle-income countries.

Despite the simplicity of the estimation specification, the raison d'etre for the life-cycle model of consumption is supported when a credit-rationing proxy is included. It is especially encouraging that Euler equations can be estimated even for highly inflationary regimes. More precise estimates of the intertemporal elasticity of substitution could be achieved by a more sophisticated mechanism for credit rationing. But introducing more parameters tends to complicate the estimation problem, diminishing the likelihood of arriving at a solution.

Intertemporal Substitution in Consumption:
Evidence from Some High- and Middle Income Countries

by
Karsten N. Pedersen

Table of Contents

Inter :mporal Substitution in Consumption: Evidence From Some High- and Middle-Income Countries.

During the last decade, many consumption planning studies have focused on consumers' intertemporal utility optimization under the efficient market hypothesis. This work was prompted in large part by Lucas' critique of econometric policy evaluation (Lucas, 1976). Early studies assumed the consumption optimization to occur in perfectly competitive markets, where the only binding constraint was the present value of consumers' life-time earnings possibly adjusted for initial wealth or bequest. Robert Hall(1978) was the first of these, he put forward a framework for consumption analysis founded on the life-cycle model of consumption. His aim was to model consumption with the first order condition of a representative individual's utility maximization. Later empirical studies, however, reject the intertemporal substitution in consumption hypothesis, because consumption seems to be overly sensitive to present income. There are two major explanations for this. First, markets are not perfect. A significant fraction of consumers are excluded from borrowing against future earnings. Lenders deny credit to consumers with lack of creditability or collateral. Moreover, quantitative regulatory measures may limit the amount of credit given at a non-price clearing level. In addition, in less-developed countries where financial markets may not be well established, consumers are credit-rationed to the extent that financial markets exist. Second, one must consider the role of expectations. Consumers expectation formation is widely debated. A number of studies suggest that individuals rather adjust consumption plans according to backward looking error-correcting mechanisms (Blinder & Deaton, 1985).

This paper attempts to find support for the life-cycle model of consumption under the assumption that some consumers are excluded from the credit market. An intertemporal model of consumption is put forward that allows a fraction of consumers to be credit rationed. The model defines credit rationing as the constraints on consumption created by lack of access to credit markets. If consumers are unable to borrow against human wealth and have no financial wealth, consumption is bound to current income. In particular, the role of quantitative instruments applied by monetary authorities and the evolution of financial markets are examined. Hence, the fraction of consumers that are rationed is allowed to change over time. The model is estimated using annual data for Brazil, Germany, Japan, Korea, Malaysia and the United States. Three "middle-income" developing countries are used to see if there is support for the life-cycle model of consumption in less developed economies. For comparative purposes three high-income countries with high quality data are also investigated. Throughout the examination it is assumed that expectations are formed rationally.

Section 1 briefly summarizes the results of a number of earlier empirical studies. Section 2 develops the regression model from the life-cycle model of consumption, with and without credit constraints. Section 3 provides the results and presents a number of test statistics. Finally, Section 4 concludes the paper.

1. Some earlier studies

Mankiw, Rotemberg and Summers (1985), and Hansen and Singleton (1982), are important early studies. Both estimate unconstrained intertemporal first order conditions of the life-cycle model (usually called the Euler equations). Mankiw et al. is significant because they test the stochastic life-cycle model without assuming separability of choice between leisure and consumption. A time separable CES-typed utility function is estimated for United States over the period 1947-80. Their results are, however, rather poor. Concavity of the utility function as well as orthogonality tests of the instrument set are rejected. The short-comings of the study point toward areas for future research. First, consumers' preferences are not necessarily constant over a period of 33 years. Second, financial markets have developed intensively over this period. The study did not include tests for rationing constraints in either the credit market or the labor market.

Hansen and Singleton's consumption function is separable in consumption and leisure. They test for two measures of consumption: non-durables and non-durables excluding services, using monthly data observations. With Generalized Moment Minimizing they estimate significant and right-signed intertemporal elasticity of substitutions. However, the restrictions implied by the orthogonality condition of the instruments are rejected. Again, liquidity constraints are not considered. Most other early studies tend to assume a non-stochastic rate of interest (for a survey see King 1985).

Flavin (1981) was the first to challenge the application of Euler equations to consumption planning, finding that consumption was "excessively sensitive" to current income. At least some fraction of consumers do not allocate consumption intertemporally, but rather plan according to a rule-of-thumb, or are shut out of the credit market and therefore are at their corner solution. Several studies elaborate on this issue. Hayashi(1982) uses U.S. data from 1948-78 to find that 17% of the population is liquidity constrained. His consumption concept includes non-durables and an imputed flow from durable goods. Hall and Mishkin(1982) find a fraction of rule-of-thumb consumers at 0.20 with a t-statistic of about 7. Their examination is based on yearly averages of food expenditures per week and yearly income from panel data. Also Hayashi(1985b) estimates the liquidity constrained fraction of consumers. He finds that about 15% are excluded from credit with a t-value of 8.

Zeldes (1989) also finds that credit constraints affect consumption planing for a substantial part of the population. From panel data he estimates Euler equations for two samples of the observation set characterized by different ratios of financial assets to income. His findings support the life-cycle model of consumption under a restriction in which a proportion of consumers are credit rationed. No exact measure is put forward, but the results show a violation of the unconstrained Euler equations for the low wealth/income ratio group while the Euler equation is validated for the high wealth/income group.

Lehmussaari's recent study focuses on quantitative restrictions imposed on financial intermediaries, (Lehmussaari, 1990). In his comparison of Scandinavian countries, he concludes that the recent deregulation of financial markets has decreased the degree of credit rationing in consumption planning. The applied framework is an error-correcting model of the Hendry type, consistent with the life-cycle model of consumption (see Blinder and Deaton, 1985).

2. The Model

Before introducing credit constraints, the basic life-cycle model of consumption is presented and the intertemporal first order condition for utility maximum -- the Euler equation -- is derived below. The Euler equation test of the life-cycle model of consumption under rational expectations was initially developed by Hall(1978), further extensions were made by Mankiw(1981) and Hansen and Singleton(1983), among others.

Let an individual's lifetime utility at time t_0 be given by:

$$U_{t_0} = \sum_{t=t_0}^{T} \beta^{t-t_0} u(c_t), \quad u(c_t) = \frac{1}{1-\alpha} c_t^{1-\alpha}, \quad u^{\prime}>0, \quad u^{\prime\prime}<0.$$

where β is the rate of time preference, c_t is consumption at time t, and α is the intertemporal elasticity of substitution. Initial wealth or bequest is omitted. U_{t0} is lifetime utility at time t_0 from consumption, implying that utility is separable within the choice between leisure and consumption. The form of the utility function is a standard von Neumann-Morgenstern utility function with constant relative risk aversion. If complete markets exist, the only binding constraint to the consumers' utility maximization problem is the lifetime budget constraint:

$$\sum_{t=t_0}^{T} \frac{1}{R_{t,t_0}} (y_t - c_t) \geq 0$$

where $R_{t,t0}$ is the real return factor between period t and t_0, and y_t is labor income at time t. Define $R_{t+1,t}$ as $\frac{(1+r)}{(1+\dot{p})}$, where r is the nominal rate of interest and $\dot{p}$ is the rate of consumer price inflation, both denoted between period t_t and t_{t+1}.

In utility maximum the market's intertemporal terms of trade of consumption between period t and period t+1 equals the intertemporal subjective terms of trade. That is:

$$\frac{\partial U_t}{\partial c_{t+1}} \cdot \frac{\partial c_t}{\partial U_t} = \beta \left(\frac{c_{t+1}}{c_t} \right)^{-\alpha} = \frac{1}{R_{t+1,t}}$$

$$\Leftrightarrow$$

$$\beta \left(\frac{c_{t+1}}{c_t} \right)^{-\alpha} R_{t+1,t} - 1 = 0$$

This intertemporal first order condition defines the Euler equation. If we move to a stochastic setting the Euler equation is reformulated as:

$$E_t\left[\beta\left(\frac{c_{t+1}}{c_t}\right)^{-\alpha} R_{t+1,t} - 1\right] = 0$$

where E_t is the expectational operator at time t.

This condition must hold for all consumers and because the expectation of the Euler equation equals zero it is necessarily independent of the information set available to the consumers. The stochastic Euler equation is therefore consistent with any subset of the information set available at time t and thus does not depend on differences in access to information among consumer (see Grosmann and Shiller, 1981). If expectations are rational, the error terms, interpreted as the discrepancy between ex ante and ex post consumption, must be orthogonal to the information set available at time t. One implication (the so-called weak axiom of the efficient market hypothesis[1]) is that the error terms over subsequent periods should be independently distributed. Since the expectation of the Euler equation is zero, the appropriate method for estimation is a non-linear instrumental variable procedure. Such a method will ensure that the observed value of the Euler equation will be orthogonal to the information set.

Turning to the credit rationing modification of the Euler equation, assume that one part of consumption follows the intertemporal optimization rule and another part is bound to consume the current level of income. The latter part captures the fraction of consumers that are at their corner solution because they are excluded from the credit market, have a non-positive financial wealth, and want to spend more than their current level of income. Let consumption in period t for optimizing consumers and credit rationed consumers, respectively, be given by:

$$c_{t+1}^{o} = \sqrt[\alpha]{\beta R_{t+1,t}}\; c_t^{o}$$

$$c_{t+1}^{c} = y_{t+1}^{c}$$

Thus, optimizing individuals plan consumption in period t + 1, due to the Euler equation. The credit constrained consumer plans to spend their entire income in period t+1. A more general

[1] See Hansen and Hodrick(1980).

interpretation of constrained consumers is to classify them as "rule-of-thumb consumers." This characterization implies a different consumption rule, for instance, $c_{t+1} = s\kappa y_{t+1}$ with $0<s<1$.

Now, to identify the consumption allocated to each group, some simplifying assumptions are needed. Assume that fraction κ of total income is received by the credit constrained consumers, i.e. $y^c_{t+1} = \kappa y_{t+1}$[2]. Furthermore, assume that fraction $1-\kappa$ of total consumption is made by optimizing consumers, i.e. $c^o_{t+1} = (1-\kappa)c_{t+1}$. Then total consumption in period $t+1$ is given by:

$$c_{t+1} = (1-\kappa)\sqrt[\alpha]{\beta\, R_{t+1,t}}\; c_t + \kappa y_{t+1}$$

Normalizing and re-writing to a stochastic setting gives:

$$E_t\left[\frac{c_{t+1} - \kappa y_{t+1}}{(1-\kappa)\sqrt[\alpha]{\beta\, R_{t+1,t}}\; c_t} - 1\right] = 0$$

Apart from allowing for asymmetries in access to information among consumers, normalization tends to eliminate heteroscedasticity in the error terms. There is no reason to expect κ to be constant over time. Here, because the focus is on the evolution of financial markets and on the gradual elimination of quantitative policy instruments imposed on financial intermediaries by central banks, κ falls over time. In the estimations presented below, κ is assumed to decline by 3 percentage points per year.

3. Results

The Euler equation is estimated under the assumption that expectations are formed rationally. The parameters (α, β, κ) are thus conditioned by the information set available at the beginning of the consumption planning period. The chosen length of the consumption planning period is limited by the data frequency, in this case, annual. The actual length of the planning period is likely to vary with the type of commodity, and therefore is different from various measures

---

[2] To be more precise, constrained consumers should receive fraction κ of labor income, but the distinction is hardly necessary in an empirical context.

of consumption data. A data frequency that is longer than the planning period means part of consumption is planned using information accraed during the data frequency period. Therefore, a better model fit would have been achieved had the data frequency been shorter. If the planning period, on the other hand, is longer than the data freqrency, the information set is no longer orthogonal to the consumption innovations accrued during the planning period, and the consumption model will be invalidated for false reasons.

The consumption measure applied here is aggregate per capita consumption. It is beyond the scope of this study to examine the Euler equation's sensitivity to different consumption measures such as food, non-durables, etc. In particular, when considering LDCs, one has to give up consumption measures more precise than total consumer expenditures, because disaggregated consumption data are not available. However, by applying an aggregate consumption measure, a separability assumption of the utility function is avoided.

Two-stage instrumental variable technique is applied to the estimation. The method is taken from Takeshi Amemiya (1974). This methods assumes that the error terms are homoscedastically conditioned on the instrument set. For a full heteroscedastic treatment of the error terms the GMM (Generalized Moment Minimizing) technique could be employed (see Hansen and Singleton, 1982).

The choice of instrument list depends upon the specification. Estimates of the unconstrained Euler equation include a constant, one period lag of the consumer price inflation, one period lag of the nominal rate of interest and one period lag of consumption. Estimates of the credit constrained Euler equation also include one-period lagged-income.

Data series are taken from the International Financial Statistics, and from the World Banks Socio-Economic database. Consumption and income series are based on average per capita. Rates of interest are dependent upon data availability. For Germany, Japan, Malaysia and the U.S., the money market rate is used. For Brazil, the Treasury Bill Rate is used, and for Korea the deposit rate is employed. All estimations are on an annual basis. The data samples cover the following time periods: Brazil, 1967-88; Germany, 1967-88; Japan, 1967-88; Korea, 1971-88; Malaysia, 1971-88; and the U.S., 1967-88.

Two specifications are estimated for each country. First, the prototype unconstrained Euler equation, and then a constrained Euler equation including a gradually declining degree of credit rationing, are estimated. Table 1 shows estimates of the rate of discount (ρ) and the intertemporal elasticity of substitution (α), along with their approximative t-statistics and the standard error of estimation for the Unconstrained Euler equation. The rate of discount is defined from the time preference parameter by $\beta = 1/(1+\rho) \Rightarrow \rho = (1-\beta)/\beta$.

As Table 1 demonstrates, none of the selected countries generate plausible results with the unconstrained Euler equation. Several countries (Japan, Germany and Malaysia) fail to fulfill the concavity condition. Others (United States, Brazil and Korea) generate time preference parameters above one.

Table 1: Estimates of unconstrained Euler equations

	α	ρ	S.E.
USA	-1.19	-.010	0.0397
	(-1.63)	(56.53)	
Japan	0.38	.031	0.0467
	(0.70)	(44.14)	
Germany	0.37	.031	0.0200
	(1.38)	(110.02)	
Brazil	-3.30	-.194	0.2078
	(-2.22)	(15.84)	
Korea	-0.93	-.029	0.0556
	(-0.83)	(16.10)	
Malaysia	0.83	.020	0.0550
	(1.92)	(52.81)	

Table 2 shows estimates of the Euler equation with the credit constraint proxy. In order to converge the estimation algorithm over the highly non-linear specification, a grid search over κ was made. The table shows that the concavity condition now is satisfied for all countries. Intertemporal elasticities of substitution are estimated within the range of 0.10 to 4.38. Moreover, with the exception of Brazil and Korea, the approximate t-statistics are all significant at a 5% level. The time preference parameters are also found within the correct range. β's are estimated between 0.92 and 0.97. All are significant at a 5% level. Apparently, no clear conclusions can be drawn about differences in the intertemporal elasticities of substitution or the time-preference parameters between the high- and middle-income countries. Brazil, however, differs from other countries in that it has a much greater sensitivity to intertemporal price (i.e. real rate) changes in consumption[3]. However, the results for Brazil should be taken with caution. Volatility is likely to add more noise to the estimation process. Hence, in the case of Brazil, t-statistics are weaker and the standard error of regression is higher. The greater volatility of the Brazilian interest rates and consumer price inflation is illustrated in figure 1.

---

[3] A total expenditure consumption measure may be particularly difficult to apply to Brazil. In a high inflation country, it is hard to discount present value of future real income. Individuals may hedge future inflation risks by piling up non-perishable goods for future consumption. This would be especially true when credit is cheap. It may explain the excessive interest rate elasticity of consumption in Brazil. On the other hand, figure 1 shows that the volatility of the real rate of interest in Brazil is much higher than other countries - particularly in the late 1980s. Thus, the high estimate of the elasticity of substitution could be due to one or more outliers.

In order to investigate this idea further, a recursive estimation of the credit constrained Euler equation was made for Brazil for the period 1983-87. Estimates of the intertemporal elasticity of substitution are shown below:

Estimation period	α
1967-83	-3.57
1967-84	-3.84
1967-85	-4.89
1967-86	-4.35
1967-87	-4.38

Apparently, the high real interest rate of 1985 draws α upward. The results, however, show that α is high even before 1985. This supports the hypothesis that hedging against inflation risk influences consumer spending in Brazil. I owe the point to Warwick McKibbin.

Table 2: Estimates of constrained Euler equations				
	α	ρ	κ	S.E.
USA	-1.45	0.031	0.073	0.0343
	(-2.60)	(94.49)	(6.06)	
Japan	-1.34	0.087	0.189	0.0372
	(-2.12)	(29.18)	(18.63)	
Germany	-0.57	0.053	0.131	0.0224
	(-2.17)	(71.11)	(11.45)	
Brazil	-4.38	0.053	0.195	0.2967
	(-1.04)	(5.68)	(4.43)	
Korea	-0.88	0.099	0.251	0.0532
	(-1.61)	(19.71)	(13.67)	
Malaysia	-0.10	0.075	0.469	0.0507
	(-2.64)	(32.61)	(22.44)	

Significant credit rationing parameters are found for all countries within the range of 7.3% to 46.9%. The results indicate that the degree of credit rationing is higher in middle-income countries than in high-income countries. κ is estimated in the 7.3% to 18.9% range for the three high-income countries. For the three middle-income countries κ is estimated in the 19.5% to 46.9% range.

Figure 1: Real rates of Interest, 1966-1988.

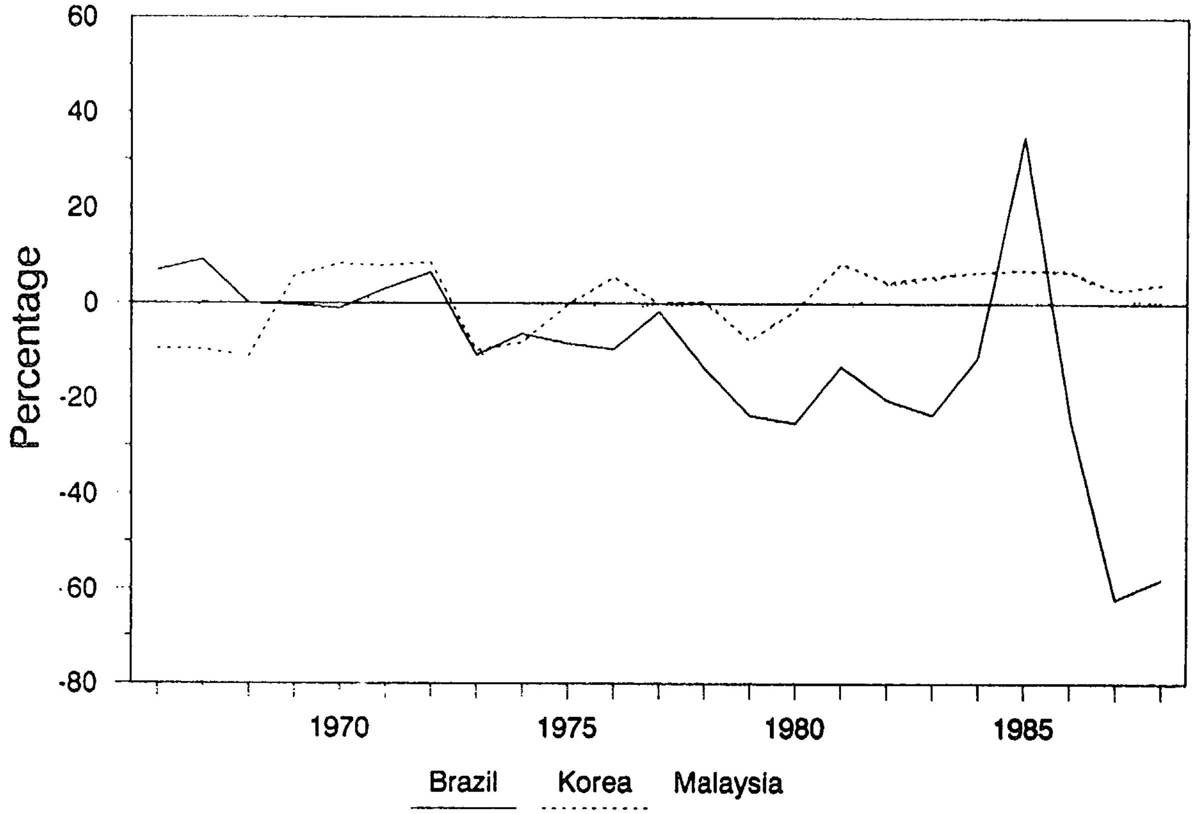

Table 3 presents results from testing the orthogonality conditions of the instrument list on the error terms. The so-called weak axiom of the efficient market hypothesis is tested. It follows from the efficient market hypothesis that any element in the information set available to consumers as they make their spending plan for time t+1, should be uncorrelated with ex post deviations between actual and planned consumption. Any difference between the ex ante and the ex post consumption plan should be orthogonal to any element of consumers' available information set at the beginning of planning period. This implies that past forecast errors will have no explanatory power over current forecast errors. The weak form of the efficient market hypothesis tests the interdependency between consumption innovations. This fairly simple orthogonality test can be carried out by ordinary least squares. Using the F-test from a regression of past forecast errors on current forecast errors, the validity of the weak form of the efficient market hypothesis is determined. Note that the fit of the F-test is a necessary, but not sufficient, condition for validation of the efficient market hypothesis. The following specification was tested:

$$e_t = b_0 + \sum_{j=1}^{4} b_j \, e_{t-j}$$

where e_t is the forecast error in period t. Applying the error terms from the estimation of the constrained Euler equation in an ordinary least square regression results in the F-statistics shown in table 3. Using the F-statistics, the significance of the joint test $b_0=b_1=b_2=b_3=b_4=0$ is described. The statistics are F(p,n-p-1) distributed, where p is the number of parameters and n is the number of observations. The 0.95 fractile of the F(5,11) distribution is 3.20, and the 0.95 fractile of the F(5,7) distribution is 3.97. The 0.90 fractiles of the same distributions are 2.45 and 2.88. H_0 is easily accepted for United States, Japan, Germany and Korea at the 10 percent level. At the same level, H_0 is close to rejection for Brazil. For Malaysia, H_0 is only approved at the 5 percent level. Thus, support for the hypothesis of independent distributed error terms seems to be somewhat weaker, but still acceptable, for the middle-income countries.

Table 3: F-test statistics

	F-test
USA	1.77
Japan	0.92
Germany	0.80
Brazil	2.10
Korea	1.35
Malaysia	3.56

Finally, the orthogonality of the instrument set on the consumption innovations is described in table 4. Correlations between error terms and the instruments are shown. The magnitude of coefficients appears to be reasonable. Only co-movements in the lagged rate of interest and the error terms have some justification, as they fall within the absolute range, between 0.20 and 0.50.

Table 4: Correlations between consumption innovations and instruments				
	Consumption	Income	Inflation	Interest rate
USA	-0.14	-0.24	-0.28	-0.50
Japan	-0.29	-0.27	-0.03	-0.20
Germany	-0.03	-0.06	-0.20	-0.27
Brazil	-0.42	0.43	0.08	0.12
Korea	0.06	0.07	-0.03	-0.42
Malaysia	-0.13	-0.15	0.40	-0.42

4. Conclusions

Not all intertemporal elacticities of substitution are estimated at significant levels, but the results are interesting nonetheless. Euler equations are estimated in well behaved domains for all countries, and the tests approve the models at acceptable levels. The weak axiom of the efficient market hypothesis is accepted at a 5 percent level for all countries except Malaysia, and the information set's orthogonality to consumption innovations is not violated for any country. Especially encouraging is the fact that Euler equations can even be estimated for highly inflationary regimes, such as Brazil's.

More precise estimates of the intertemporal elasticity of substitution might be achieved, however, by a more sophisticated credit rationing mechanism. As a start, a grid search of an optimal rate of decline in credit-rationing over time could be made. On the other hand, the introduction of more parameters tends to complicate the estimation problem, and thus diminishes the likelihood of solution convergence.

Not surprisingly, the results show that the level of credit rationing is higher in the middle-income countries than in the high-income countries. Also, the models of middle-income countries are estimated with higher uncertainty (standard errors of regression are higher for the three middle-income countries than for the three high-income countries). This could indicate that the representative consumer assumption which is particularly sensitive to changes in income distribution, is questionable for middle-income countries. In addition, volatile real rates of return add more noise to the estimation, which is especially important for Brazil. However, in spite of the simplicity of the estimation specification, the raison d'etre for the life-cycle model of consumption is supported when a credit-rationing proxy is included.

References:

Amemiya, Takeshi, "The Non-linear Two-stage Least-squares Estimator," Journal of Econometrics 2, July 1974.

Blinder, Alan A. and Deaton, Agnus "The Time-Series Consumption Function Revisited" Brookings Papers on Economic Activity:2 (1985).

Campbell, John Y. and Clarida, Richard H. "Household Saving and Permanent Income in Canada and the United Kingdom" NBER Working Paper 2223 (April 1987).

Campbell, John Y. and Mankiw, N. Gregory "Permanent Income, Current Income, and Consumption" NBER Working Paper 2436 (November 1987).

Campbell, John Y. and Mankiw, N. Gregory "Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence" NBER Working Paper 2924 (April 1989).

Deaton, Agnus "Saving and Liquidity Constraints" NBER Working Paper 3196 (December 1989).

Flavin, Marjorie A. "The Adjustment of Consumption to Changing Expectations about Future Income." Journal of Political Economy 89 (October 1981).

Grossman, S.J. and Shiller, R.J. (1981), "Determinants of the Variability of Stock Market Prices," American Economic Review 71, papers and proceedings.

Hall, Robert E. "Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence." Journal of Political Economy 86 (December 1978).

Hall, Robert E. and Mishkin, Frederic S. "The Sensitivity of Consumption to Transistory Income: Estimates from Panel Data on Households." Econometrica 50 (March 1982).

Hall, Robert E. "Intertemporal Substitution in Consumption" Journal of Political Economy 96 (April 1988).

Hansen, L.P. and Hodrick, R.J. "Forward Exchange Rates as Optimal Predictors of Future Spot Rates: An Econometric Analysis" Journal of Political Economy 88 No. 5 (1980).

Hansen, L.P. and Singleton, K.J. "Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models" Econometrica 50 No. 5 (1982).

Hansen, L.P. and Singleton, K.J. "Stochastic Consumption, Risk Aversion, and the Temporal Behavior of Asset Returns." Journal of Political Economy 91 (April 1983).

Hayashi, Fumio "Tests for Liquidity Constraints: A Critical Survey." NBER Working Paper 1720 (October 1985).

Hayashi, Fumio "The Permanent Income Hypothesis and Consumption Durability: Analysis Based on Japanese Panel Data." Q.J.E. 100 (November 1985).

Hendry, David F., and von Ungern-Sternberg, Thomas "Equidity and Inflation Effects on Consumers' Expenditure' in Essays in the Theory and Measurement of Consumer Behavior, ed. by Angus Deaton (Cambridge University Press, 1981).

King, Mervyn "The Economics of Savings, A Survey of Recent Contributions." in Frontiers of Economics, e. K.J. Arrow and S. Honkapohja, Basil Blackwell (1985).

Koskela, Erkki " The Theory of Consumption Function with Borrowing Constraints" Schweizeriche Zeitschrift fur Volkswirtschaft und Statistik (1978).

Koskela, Erkki and Viren, Matti "Credit Rationing and Consumer Intertemporal Choice." Oxford Economic Papers 36 (1984).

Lehmussaari, Olli-Pekka "Deregulation and Consumption: Saving Dynamics in the Nordic Countries." IMF Staff Papers 37 No. 1 (March 1990).

Lucas, Robert E., Jr. "Econometric Policy Evaluation: A Critique", in Carnegie-Rochester Conference Series on Public Policy 1 (1976).

Mankiw, N. Gregory "The Permanent Income Hypothesis and the Real Interest Rate" Economic Letters 7 (1981).

Mankiw, N. Gregory; Rotemberg, Julio J. and Summers, Lawrence H. "Intertemporal Substitution in Macroeconomics." Q.J.E. 100 (February 1985).

Summers, Lawrence H. "Tax Policy, the Rate of Return, and Savings" NBER Working Paper 995 (1982).

Zeldes, Stephen P. "Consumption and Liquidity Constraints: An Empirical Investigation." Journal of Political Economy 97 (1989)

Zeldes, Stephen P. "Optimal Consumption with Stochastic Income: Deviations from Certainty Equivalence." Q.J.E. 104 (May 1989).

PRE Working Paper Series

	Title	Author	Date	Contact for paper
WPS627	The Role of Institutions in Poverty Reduction: A Focus on the Productive Sectors	Sharon L. Holt	March 1991	WDR Office 31393
WPS628	The Indonesian Family Planning Program: An Economic Perspective	Dov Chernichovsky Henry Pardoko David De Leeuw Pudjo Rahardjo Charles Lerman	March 1991	O Nadora 31091
WPS629	An Atheoretic Evaluation of Success in Structural Adjustment	Patrick Conway	March 1991	D Ballantyne 37947
WPS630	The Spirit of Capitalism and Long-run Growth	Heng-fu Zou	March 1991	A. Bhalla 37699
WPS631	The Macroeconomics of the Public Sector Deficit: The Case of Morocco	Riccardo Faini	March 1991	R. Luz 34303
WPS632	The Macroeconomics of the Public Sector Deficit: The Case of Argentina	Carlos Alfredo Rodriguez	March 1991	R. Luz 34303
WPS633	The Macroeconomics of the Public Sector Deficit: The Case of Thailand	Virabongse Ramangkura Bhanupongse Nidhiprabha	March 1991	R. Luz 34303
WPS634	Trends in Developing Country Exports, 1963-88	Bela Balassa	March 1991	WDR Office 31393
WPS635	Exchange Rates and Foreign Trade in Korea	Bela Balassa	March 1991	C. Cuskelly-Young 39413
WPS636	Economic Integration in Eastern Europe	Bela Balassa	March 1991	C. Cuskelly-Young 39413
WPS637	Poverty in Poland, 1978-88	Branko Milanovic	March 1991	WDR Office 31393
WPS638	Researching the Trade-Productivity Link: New Directions	James Tybout	March 1991	D. Ballantyne 37947
WPS639	The High Cost of Protecting Uruguay's Automotive Industry	Wendy E. Takacs	March 1991	D. Ballantyne 37947
WPS640	The Impact of Policy in African Agriculture: An Empirical Investigation	William Jaeger	March 1991	A. Yideru 34663

PRE Working Paper Series

	Title	Author	Date	Contact for paper
WPS641	Intertemporal Substitution in Consumption. Evidence for Some High- and Middle-Income Countries	Karsten N. Pedersen	April 1991	M. Hileman 31284
WPS642	How a Change in Brazil's Sugar Policies Would Affect the World Sugar Market	Brent Borrell	April 1991	A. Kitson-Walters 33712
WPS643	Regional Integration among Developing Countries, Revisited	Andras Inotai	April 1991	D. Ballantyne 37947